Revision of the *Macrozamia miquelii* (F.Muell.) A.DC. (Zamiaceae section *Macrozamia*) group

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Summary

Jones, David L., Forster, Paul I., Sharma Ish K. (2001). Revision of the *Macrozamia miquelii* (F. Muell) A.DC (*Zamiaceae* section *Macrozamia*) group. Austrobaileya 6 (1): 67–94. The *Macrozamia miquelii* group consists of seven species, *M. cardiacensis* P.I.Forst. & D.L.Jones, *M. douglasii* W.Hill ex F.M.Bailey, *M. longispina* P.I.Forst. & D.L.Jones, *M. macleayi* Miq., *M. miquelii* (F.Muell.) A.DC., *M. mountperriensis* F.M.Bailey and *M. serpentina* D.L.Jones & P.I.Forst. sp.nov., all occurring in eastern Queensland. The complicated typification of *Macrozamia douglasii* W.Hill ex F.M.Bailey and *Encephalartos douglasii* F.Muell. is resolved with lectotypes selected for both names. A key to the species in the group is provided and all species are illustrated. A partial electrophetic analysis of the complex is also presented.

Keywords: Zamiaceae, Key, taxonomy, electrophoresis, *Macrozamia miquelii, Macrozamia serpentina*

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Introduction

The genus *Macrozamia* Miq. consists of thirty-eight named species and a few others yet to be recognised formally. The genus is endemic to mainland Australia with the vast majority of species (c. 36) occurring in the eastern states of Queensland and New South Wales. Another six (including unnamed species) are known to occur in Western Australia and a single, isolated relict species is restricted to Central Australia. While some species of *Macrozamia*, such as *M. riedlei* (Fisch. ex Gaudich.) C.A.Gardner and *M. communis* L.A.S.Johnson, have a wide distribution, others, such as *M. cranei* D.L.Jones & P.I.Forst. and *M. viridis* D.L.Jones & P.I.Forst., are narrow endemics restricted to relatively small areas and specialised habitats.

This paper examines the systematics, morphology and relationships of the group of species centred around *Macrozamia miquelii* (F.Muell.) A.DC. in *Macrozamia* section *Macrozamia.* This group is defined by the intermediate size of the plants, untwisted or slightly twisted leaves that have spinescent petioles and hypostomatic leaflets with the lower leaflets grading into pinnacanths or the latter absent in some species. These features are shared by a group of three species allied to *M. communis* L.A.S.Johnson, but the *M. miquelii* group can be distinguished from these by narrow-based spines on the female sporophylls (c. 2-5 mm wide cf. 5–12 mm wide in the *M. communis* group). Species of the *M. miquelii* group form small to large cycads that are generally much larger than species in *Macrozamia* section *Parazamia* and smaller than the largest species of *M.* section *Macrozamia* such as *M. macdonnellii* (F.Muell. ex Miq.) A.DC., *M. moorei* F.Muell. and *M. johnsonii* D.L.Jones & K.D.Hill, all of which have amphistomatic leaflets. All of these species in *Macrozamia* section *Macrozamia* appear to be insect pollinated, either by thrips, beetles or a combination of the two (Forster *et al.* 1994; Forster, unpubl.; Mound & Terry 2000).

The earliest described species of the group, *Macrozamia miquelii,* was first named in *Encephalartos* by Mueller (1862), but was

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soon transferred to *Macrozamia* by De Candolle (1868). Additional species were added by Miquel (1868a,b) and Bailey (1883, 1886). Johnson (1959) took an extremely conservative view of the complex reducing all published names to synonymy of *M. miquelii* and also lectotypified this name using a type from Rockhampton (Forster 1999a). Further new species were recently added by Forster & Jones (1998) as part of the *Flora of Australia* account compiled by Hill (1998).

Although concise descriptions of five species from this group have been provided in the *Flora of Australia* by Hill (1998), there are numerous discrepancies in measurements between our observations and his accounts of *Macrozamia douglasii, miquelii* and *M. mountperriensis,* necessitating redescription of these species. Additionally the circumscription of *M. miquelii* is altered in the current paper with *M. macleayi* being resurrected from synonymy. Hence we provide detailed descriptions for all seven species in the group.

Materials and Methods

All species dealt with in this paper were examined in the field. Measurements cited here were made mainly from living material of adult plants, with some supplementation from herbarium collections, particularly those at BRI, CANB and MEL. Juvenile material of all species will generally have quite dissimilar leaves in terms of dimensions and component parts. The key is designed to be used with fertile material and adult leaves. When referring to "leaflets" in the descriptions, it indicates the total number of leaflets in the leaf. Leaflet dimensions are based on mature leaves and the leaflets from the central portion of the leaf. More accurate identifications will be arrived at if collectors either use the key on plants *in situ* or collect a range of leaves and cones, as there is often considerable variation even on a single individual. All types have been seen unless indicated n.v. Specimens of known sex are cited as A (female) or B (male), or C (seedling) following the collector's number. Some locality details in the citation of specimens are abbreviated or omitted for conservation purposes.

Limited allozyme analysis has been attempted for the complex but should not be regarded as all-encompassing. One species (*M. serpentina*) was not included in the analysis due to the loss of collected samples. The methodology used for the starch gel electrophoresis is the same as previously described (Sharma *et al.* 1999). Table 1 shows localities of species, vouchers and the number of samples used for analysis. Nei's genetic distance coefficient (Nei 1978) was used to measure the level of genetic differentiation among populations and species. Based on these values, a dendrogram (Fig. 1) was constructed (see Sharma *et al.* 1999 for details), which revealed that all the populations clustered into groups corresponding with the respective species.

Population codes, voucher numbers and sample size of the six species of *Macrozamia* examined in this study are listed below. Voucher details are given in the specimen citation for individual taxa (Table 1).

Table 1. Population codes, voucher details and sample size of collections used in isoenzyme analysis.

	M. mountperriensis	
BRO	Forster PIF9343 & Machin	26
SNY	Forster PIF13321 & Machin	26
GOO	Forster PIF2771	14
SEA	Forster PIF13372 & Machin	26
MON	Forster PIF13984 & Machin	14
SCH	Jones DLJ 6340 & Jones	26

	M. longispina	
WOO	Forster PIF13374 & Machin	26
WID	Forster PIF12137A-C & Machin	32
	M. miquelii	
BYE	Jones DLJ 9393	32
ARC	Forster PIF12253A-B & Machin	32
KPL	Forster PIF12268 & Machin	32
MOR	Forster PIF12251A-C & Machin	32
	M. macleayi	
BLK	Forster PIF12277A-B & Machin	32
BUL	Forster PIF12289A-B & Machin	28
BUR	Forster PIF12299A-B & Machin	28
BAN	Forster PIF13983 & Machin	28
KAL	Forster PIF13980A-B & Machin	28
KOO	Forster PIF12285A-B & Machin	28
IMB	Forster PIF13146 & Machin	28
	M. douglasii	
DOG	Forster PIF9346 & Machin	26
COO	Machin PM17	21
	M. cardiacensis	
CAR	Forster PIF13109A-C & Machin	32

Taxonomy

Key to species of the *Macrozamia miquelii* group

1. Lower 8 or more leaflets reduced to pinnacanths 2
   Lower 4 or less leaflets reduced to pinnacanths, or pinnacanths absent 5

2. Female cones narrowly ovoid; male cones 35–40 cm long ..... **1. M. cardiacensis**
   Female cones cylindrical to barrel-shaped; male cones 12–28 cm long 3

3. Male cones 2.5–3.5 cm diameter; microsporophylls 8–12 × 4–8 mm ..... **7. M. serpentina**
   Male cones 3.5–6.5 cm diameter; microsporophylls 12–25 × 8–15 mm 4

4. Leaves glossy above, thin-textured; female cones 7–10 cm diameter ..... **4. M. macleayi**
   Leaves dull to slightly glossy above, thick-textured; female cones 10–15 cm diameter ..... **5. M. miquelii**

5. Lower 1–4 leaflets reduced to pinnacanths ..... **2. M. douglasii**
   Pinnacanths absent 6

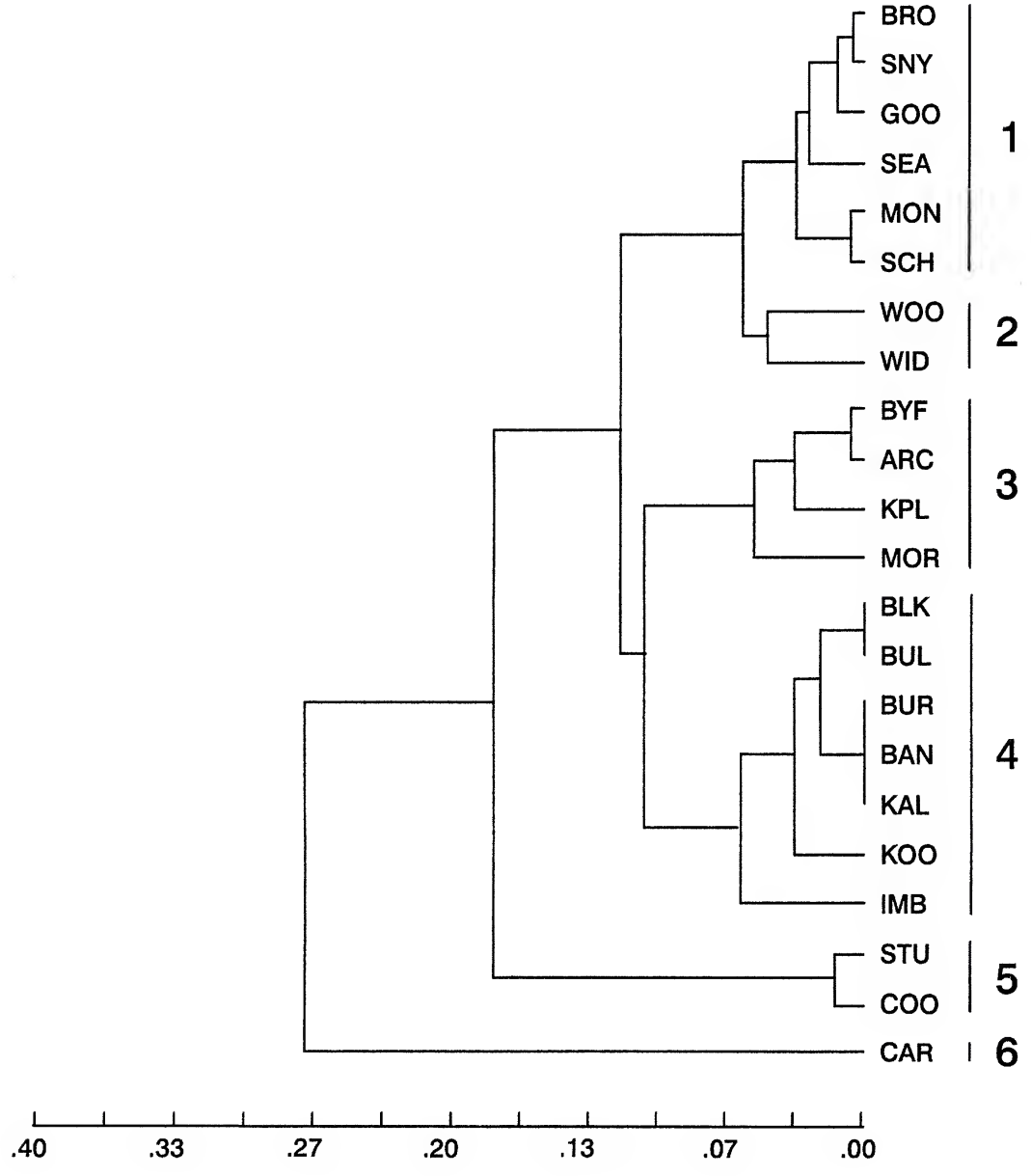

Fig. 1. Allozyme Based Dendrogram of *Macrozamia* species and populations based on Nei's unbiased Genetic Distance. 1=*M.mountperriensis*; 2=*M.longispina;* 3=*M.miquelii*; 4=*M.macleayi*; 5=*M.douglasii*; 6=*M.cardiacensis.*

Fig. 2. *Macrozamia cardiacensis*. Adult in habitat with P.Machin for scale. *Forster* PIF12151 & *Machin*. Photo: P.I.Forster.

6. Leaflets 50–110, 6–9 mm wide; male cones 12–25 × 3–4 cm; distal megasporophylls with spines 2.5–4 cm long ..... **6. M. mountperriensis**
   Leaflets 100–140, 3–6 mm wide; male cones 8–15 × 2.5–4 cm; distal megasporophylls with spines 4.5–7 cm long ..... **3. M. longispina**

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1. Macrozamia cardiacensis P.I.Forst. & D.L.Jones *in* P.McCarthy (ed.), *Fl. Australia* 48: 717 (1998). **Type:** Queensland. WIDE BAY DISTRICT: Cardiac Hill, Mt Walsh National Park, 26 February 1993, *P.I.Forster 13109A & P.Machin* (holo: BRI).

Caudex usually subterranean, occasionally emergent, erect, columnar or barrel-shaped, to 40 cm long, 20–40 cm diam., unbranched. Young leaves light green. Mature leaves elliptic-lanceolate in outline, 1–2 m long, obliquely erect to spreading, dark green, glossy, flat in cross-section, arching in profile, 10–20 in a moderately dense crown; expanded leaf base 9–12 cm × 3–4 cm, covered with grey-brown, soft woolly hairs; petiole (including the expanded base) 30–40 cm long, 1.5–2 cm wide at the first leaflet, flat adaxially, convex and angular abaxially; rhachis straight, not twisted, flat adaxially, the cross-section similar to that of the petiole; leaflets 100–140 per leaf, inserted at about 40° to the rhachis, crowded, distal leaflets densely packed, proximal leaflets progressively more widely spaced, linear, 20–31 cm × 0.8–1.2 cm, flat, moderately thin-textured, hypostomatic, dark green & glossy adaxially, paler beneath, contracted proximally to a pale yellow callous base, margins flat, entire, tapered to a pungent apex; lower 4–7 pairs of leaflets gradually reduced to rigid pinnacanths. Male cones 1–5, cylindrical, 35–40 cm × 6.5–8 cm, straight or curved with age, green; peduncle 15–30 cm × 1.5–2.5 cm, elliptical to round in cross-section; microsporophylls cuneate, 2.2–3.2 cm × 1–1.5 cm, with an erect, apical spine 0.2–2.5 cm long. Female cones 1 or 2, narrowly ovoid, 32–36 cm × 11–14 cm, green; peduncle 20–25 × 1.6–2.5 cm, elliptical to rounded in cross-section; megasporophylls 4–4.5 cm × 3.5–4.7 cm, broadly cuneate, with an erect apical spine 1–5 cm long, the distal sporophylls with spines 4.5–

Fig. 3. *Macrozamia cardiacensis*. Female plant with cones. *Forster* PIF13109A & *Machin* (type). Photo: P.I.Forster.

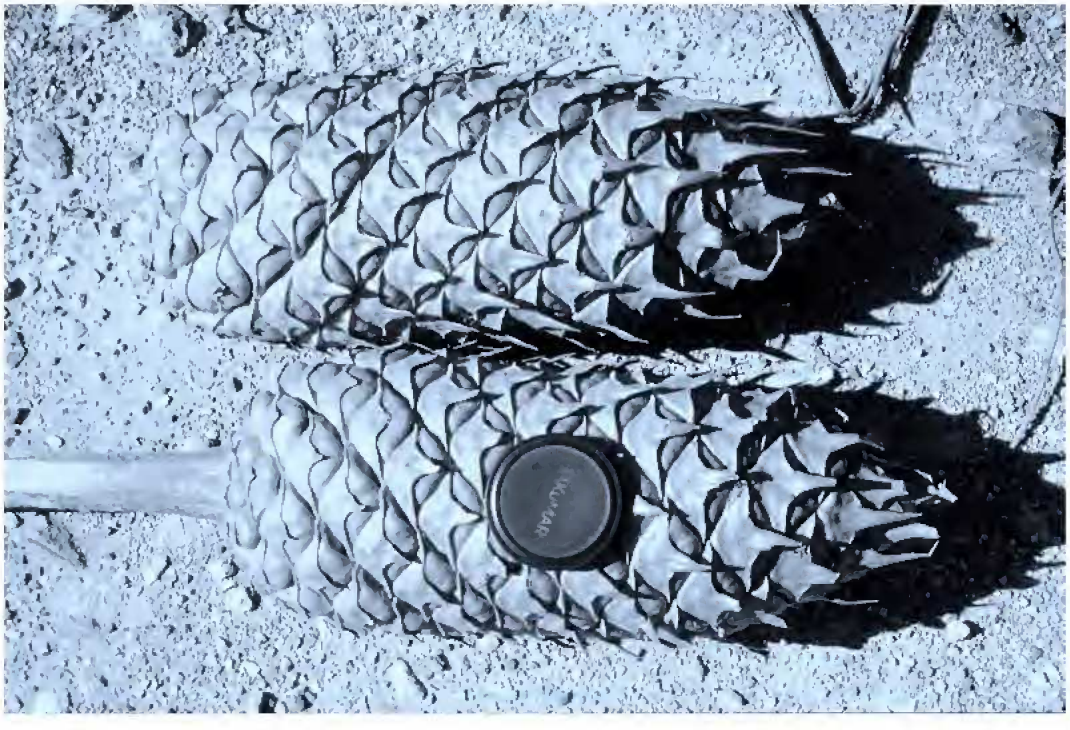
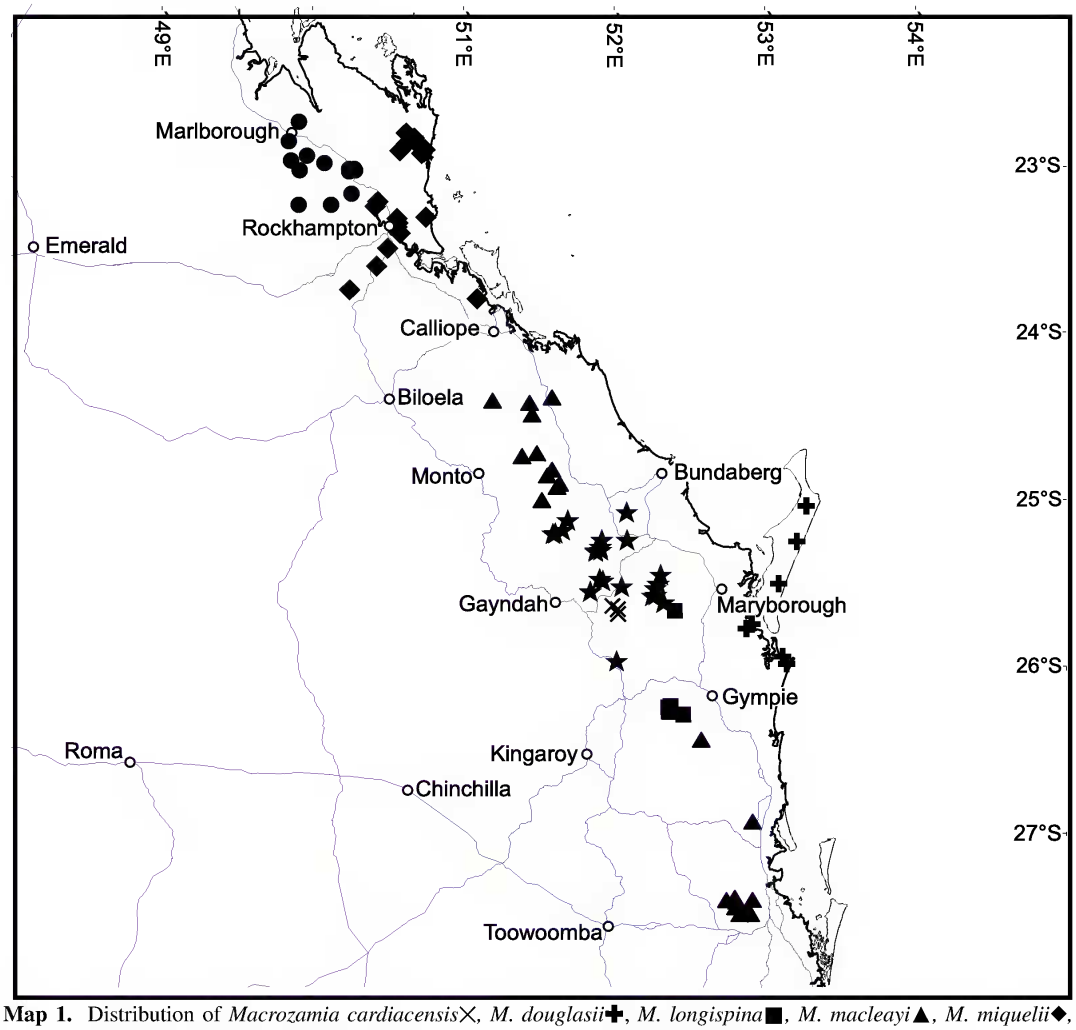


Fig. 4. *Macrozamia cardiacensis*. Detail of female cones. *Forster* PIF13109A & *Machin* (type). Photo: P.I.Forster.



Map 1. Distribution of *Macrozamia cardiacensis*×, *M. douglasii*✚, *M. longispina*■, *M. macleayi*▲, *M. miquelii*◆, *M. mountperriensis*★, *M. serpentina*● based on herbarium records in BRI, CANB and MEL.

5 cm long. Seeds oblong to ovoid, 2.2–3.5 cm × 1.2–2 cm, sarcotesta orange to dark red. (Fig. 2–4).

***Selected specimens*: Queensland**. WIDE BAY DISTRICT: Mt Walsh N.P., Coast Range, Oct 1992, *Forster* PIF12151 & *Machin* (BRI); ditto, Feb 1993, *Forster* PIF13109B & *Machin* (BRI); ditto, May 1994, *Forster* PIF15232 & *Bean* (BRI); ditto, Mar 1995, *Forster* PIF16367 (BRI); Coast Range, Oct 1995, *Grimshaw* PG2212 (BRI); ditto, *Grimshaw* PG2401 (BRI); Mt Walsh N.P., Coast Range, Aug 1992, *Machin* PM16-19 (BRI); Mt Walsh, 6.5 km S of Biggenden, May 1977, *Telford 5322* (CANB).

Distribution and habitat: *M. cardiacensis* (Map 1) is restricted to the Mount Walsh National Park near Biggenden in the Wide Bay District of Queensland. It grows in skeletal soils on steep to precipitous slopes on substrates derived from rhyolites or andesites at altitudes between 500 and 640 m in open eucalypt forest. Associated canopy species are *Eucalyptus andrewsii*, *E. decolor*, *E. acmenoides* and *Corymbia citriodora*.

Phenology: Cones shed pollen in November and December. Both male and female cones are attended by the thrips *Cycadothrips chadwickii* and a species of *Tranes* (P.I.Forster, pers. obs. Dec. 2000). *Macrozamia cardiacensis* is the only species in the *M. miquelii* group that has been observed to have both of these insects present. Ripe seeds are dispersed from March to May.

Notes: Plants usually have a subterranean trunk but on rocky sites or in shallow soils an emergent trunk is often formed.

Macrozamia cardiacensis is similar to both *M. miquelii* and *M. douglasii*. It differs from *M. miquelii* by its larger cones with longer apical spines on the distal megasporophylls and from *M. douglasii* by its more numerous pinnacanths, less prominent callous base and longer apical spines on the distal megasporophylls. It is perhaps most closely allied to *M. douglasii* on morphological characters, and the limited allozyme analysis based on few populations of the two species tends to support this (Fig. 1).

Conservation status: Although of restricted distribution *M. cardiacensis* is locally abundant in two localities, growing in dense colonies with strong seedling recruitment. This species is listed as Rare on the schedules of the Queensland Nature Conservation Act 1992 although it is conserved in Mt Walsh National Park.

Etymology: Named for the type locality of "Cardiac Hill" and also alluding to the difficulty experienced by the co-collectors of the type in transporting the heavy female cones.

2. Macrozamia douglasii W.Hill ex F.M.Bailey, *Syn. Queensland Fl.* 500 (1883).**Type:** Queensland. WIDE BAY DISTRICT: [comprises a pressed leaf] Fraser Island, [forwarded 24 April 1882 to K by J.Pink], *Sheridan* s.n. (lecto (here designated): K, photo!).

Encephalartos douglasii F.Muell., *Chem. Drugg. Australas.* 5: 80-81 (14 February 1883); *Macrozamia tridentata* var. *douglasii* (F.Muell.) J.Schust. in A.Engler, *Pflanzenr.* 99 (IV, I): 90 (1932). **Type:** Queensland. WIDE BAY DISTRICT: [comprises 5 bags of fruit & a photograph of an intact cone] Fraser Island, [collected prior to 17 Jan 1883 when forwarded to Mueller], *A.McDowall* s.n. (lecto [here designated]: MEL269564; isolecto: K [2 sheets of three portions of the one pressed frond, plus a copy of the photo of the intact cone] photo!).

***Illustrations*:** Ballard (1936: t. 3310, 3311); Jones (1993: 237).

Caudex subterranean or emergent, to 1 m tall and 70 cm diam., unbranched. Young leaves light green. Mature leaves elliptic-lanceolate in outline, 2–3.5 m long, erect to obliquely erect or widely spreading, bright green to dark green, flat in cross-section, arching in profile, 30–90 in a dense crown; expanded leaf base 10–15 cm × 3–4 cm, covered with greyish-white, soft woolly hairs; petiole (including the expanded base) 40–60 cm long, 12–20 mm wide at the first leaflet, green, flat or grooved adaxially, convex and angular abaxially; rhachis straight, not twisted or slightly twisted, pale green, the cross-section similar to that of the petiole; leaflets 120–200, inserted at about 40° to the rhachis, widely spreading, moderately crowded, distal leaflets densely packed, proximal leaflets becoming more widely spaced, linear,flat, moderately thin-textured, hypostomatic, 25–35 cm × 8–12 mm, dark green and glossy adaxially, paler beneath, contracted proximally to a prominent white callous base, margins entire, tapered to a sharply pointed apex; lower leaflets gradually reduced to 1–4 pairs of rigid, moderately long, yellowish pinnacanths. Male cones 1–3, cylindrical, 20–35 cm × 5–7 cm, straight or curved with age, green; peduncle 20–35 cm × 2–3 cm, elliptical in cross-section; microsporophylls cuneate, 2–3.5 cm × 1.5–2.5 cm, with an erect, apical spine 0.5–4 cm long. Female cones 1–3, cylindrical to barrel-shaped, 35–45 cm × 10–18 cm, green; peduncle 25–45 cm× 2–3 cm; megasporophylls broadly cuneate, 2.5–3.5 cm × 4–6 cm, with an erect, apical spine 1–4 cm long, the distal sporophylls with spines 3–4 cm long. Seeds oblong, 2.8–4 cm x 1.8–2.5 cm, sarcotesta orange to red. (Figs. 5–8).

***Selected specimens*: Queensland.** WIDE BAY DISTRICT: Cowra Logging Area, Tuan State Forest, Jan 1992, *Forster* PIF9346 A & B *& Machin* (BRI, CANB); ditto, Nov 1992, *Forster* PIF12330 *& Machin* (BRI); Great Sandy National Park – Cooloola section, Aug 2000, *Forster* PIF25968 *& Kokubugata* (BRI); Fraser Island, Nov 1930, *Hubbard* 4552 (BRI; K n.v.); Fraser Island, c. 0.1 km from Dilli towards Ungowa, Apr 1992, *Jones* 9414 *& Jones* (CANB); Fraser Island, c. 2 km W of Eumong, May 1992, *Jones* 9429 & *Jones* (BRI, CANB); Shark Creek, opposite southern end of Fraser Island, Jan 1928, *Kajewski* 1 (BRI); Fraser Island, May 1992, *Machin* (CANB); Tuan Ck, near Tin Can Bay, May 1992, *Machin* (CANB); Cooloola area, S.F. 451 Womalah, Jun 1993, *Machin* PM7 (BRI); Cooloola, Stutz Hut road, S.F. 915, Jul 1992, *Machin* PM21-22 (BRI); Cooloola, off Tinnanbar road, S.F. 451 Womalah, Jul 1992, *Machin* PM23-25 (BRI); Cooloola State Forest, Sep 1970, *Moriarty 434* (CANB); Fraser Island, Mar 1951,

Fig. 5. *Macrozamia douglasii*. Habit. Fraser Island. Photo: D.L.Jones.

Webb SW4761 (CANB); Fraser Island, Oct 1921, *White* AQ142034 (BRI).

Distribution and habitat: *Macrozamia douglasii* (Map 1) occurs on Fraser Island, where it is extremely abundant, and on adjacent coastal districts near Cooloola north of Noosa, both regions in the Wide Bay District. It grows at altitudes between 10-80 m in tall open forests developed on old coastal dunes, along streams and on the fringes of rainforest, with some specimens occurring within the rainforest canopy. The soils are deep grey to white sands with a permanent water table.

Phenology: Pollen shedding occurs in November with the cones attended by hordes of *Tranes* weevils (Forster *et al.* 1994). Ripe seeds are dispersed from March to April.

Typification: The typification of this twice published species is very complex. The species was first named *Encephalartos douglasii* by Mueller (1883) and soon after, and apparently independently, as *Macrozamia douglasii* by Bailey (1883). Both names were validations of the nomen nudum *Macrozamia douglasii* W.Hill (1879), but when used in *Macrozamia*, Bailey's name takes precedence. Bailey did not explicitly cite a type specimen (which was not unusual at the time) and it appears that a progression of material was sent to various herbaria and botanic gardens by a range of collectors around this time with the resultant

Fig. 6. *Macrozamia douglasii.* Female cone. Fraser Island. Photo: D.L.Jones.

descriptions being compiled from all (or at least most) of them. Bailey named this species "After the Hon. John Douglas" thus validating the unpublished name of Walter Hill's. Further on he states "(*Fraser's Island.*)". This has been incorrectly interpreted as "Fraser Island, Qld, *Douglas*; holo: BRI" by Hill (1998); however, no such specimen exists at BRI. In the *Synopsis* Bailey did not explicitly cite who the collectors of any new taxa were. Hence it does not necessarily follow that Douglas collected material of this species at all, and it is probable that the material used by Bailey in his description was collected by W. Hill or one of his contacts. W. Hill first coined the specific epithet and stated "Frazer's Island. During my visit to the above island, in April last, I took the opportunity of making a collection of the various seeds and plants flourishing there, and I am glad to say that I was enabled to secure a number of very interesting specimens, including Macrozamia douglasii , W. H. (*Goulbine*) (the nuts of this tree are largely used as an article of food by the aborigines)"(Hill 1879). Ballard (1936) cites collections by W. Hill in 1881, J. Pink in 1882 and A. McDowall in 1883, but does not state where these collections are deposited.

We have been able to locate four separate collections of this species from the early 1880's deposited in K and MEL, all of which must be critically examined for the typification of these

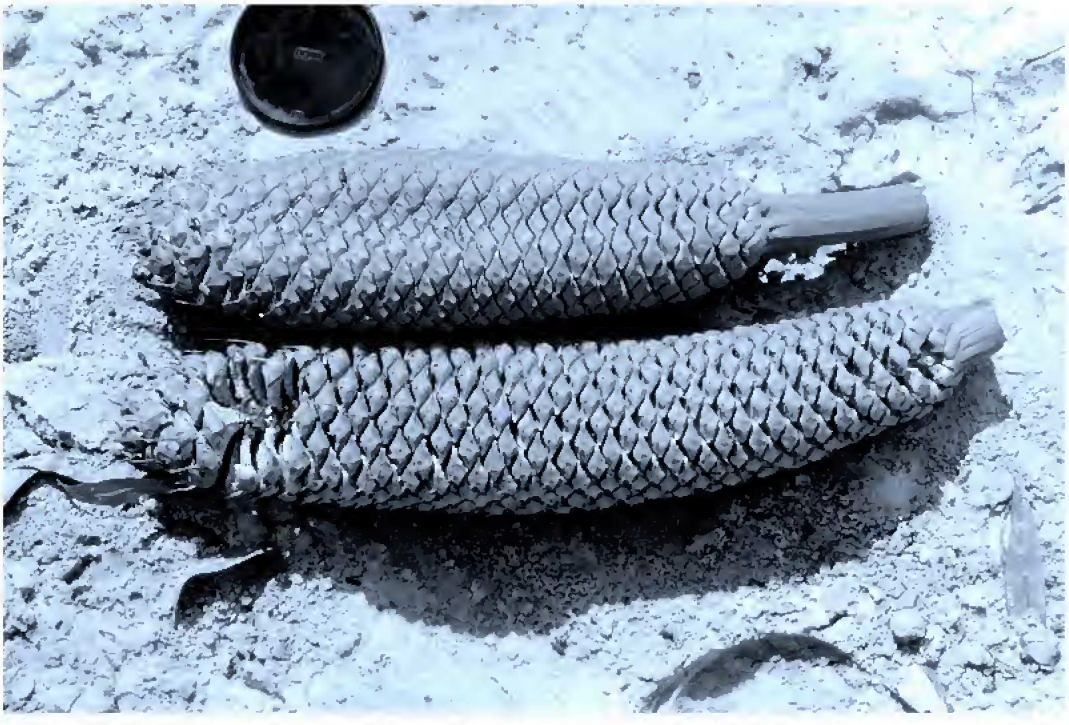


Fig. 7. *Macrozamia douglasii*. Male cones. *Forster* PIF12330 & *Machin*. Photo: P.I.Forster.

Fig. 8. *Macrozamia douglasii*. Detail of apical portions of male cones. *Forster* PIF12330 & *Machin*. Photo: P.I.Forster.

two names. No potential type material was located at BRI, despite extensive searching. None of these collections are by John Douglas. There are only seven collections by Douglas at BRI, all of which are ferns collected in June 1893 from Thursday Island where he was Government Resident and Police Magistrate (Joyce 1972).

Collections in question are: Specimen #1: MEL237356 (labelled as syntype). This comprises a pressed, partial and somewhat immature leaf and is labelled as "*Encephalartos Douglasii* F.vM. *Macroz. Douglasii* Ex horto. bot. Brisbane 1881".

Specimen #2: MEL269564 (labelled as syntype). This comprises four bags of seed and cone remnants and is accompanied by a photographic print of an intact cone in a wired (or perhaps string) cage and a long letter to Mueller from A.McDowall of Maryborough dated 17 January 1883. According to the letter four ripe cones were originally sent from Fraser Island. It is reasonable to assume that the collector of this material was A.McDowall. A copy of this photographic print is also at K.

Specimen #3: K. This comprises a pressed partial leaf and is accompanied by a letter by James Pink of the Brisbane Botanic Gardens to Thiselton-Dyer at K that is dated 24 April 1882. In the letter Pink quite clearly states that the material of *Macrozamia* was collected by "Mr Sheridan Collector of Customs & Police Magistrate Maryborough".

Specimen #4: K. This comprises a whole pressed leaf that is divided into three pieces and mounted on two sheets. The material is accompanied by a letter from Mueller to Thiselton-Dyer dated 17 February 1883 where it is stated that the collection is by A.McDowall. This material appears to be the leaf material that originally accompanied the four bags of seed in MEL (see specimen #2). Mueller states in the letter "It was my intention, dear Mr Dyer, to have sent you a female amentum of *Encephalartos Douglasii* by this mail, but it is not yet dry, nor is the photograph likely to get ready in time. So I shall keep back also leaves and male cone til next post".

Mueller (1883) in the description of *E. douglasii* quite clearly states that "through the kindness of Mr. A.McDowall, the districts' lands office and surveyor of Maryborough, Wide Bay, to place this cycadeous plant on diagnostic record". The name *Encephalartos douglasii* F.Muell. is adequately typified by the A.McDowall collection (specimen # 2), as this material is annotated by Mueller, collected prior to the publication of the name and referred to in the protologue. The collection has been split between MEL and K, with the former designated as lectotype and the latter isolectotype for this name.

This then leaves the problem of typification for *Macrozamia douglasii* W.Hill ex Bailey. As no type was explicitly cited, we are left with a number of options, either selection of a lectotype from the available collections or selection of a neotype. We cannot prove that the McDowall collection was seen by Bailey and it would appear that McDowall sent the material directly to Mueller, hence it is not appropriate to consider the type of both names to be the same.

Bailey would undoubtedly have seen the live material acquired by Hill or Sheridan. It is quite possible that Mueller sent a copy of his description of *Encephalartos douglasii* to Bailey and so the name *Macrozamia douglasii* is merely a new name in a different genus for the entity based on the McDowall specimen. The collection by Sheridan at K (specimen # 3), although only of a pressed leaf, is here designated as the lectotype for the name *Macrozamia douglasii* as it comprises a mature leaf undoubtedly prepared from a live plant in the Brisbane Botanic Gardens, and is likely to have been seen by Bailey.

Notes: *Macrozamia douglasii* is similar to *M. miquelii* but can be distinguished by the lustrous dark green leaves, extremely conspicuous, intensely white callous bases and only the lowest 1–4 pairs of leaflets reduced to spine-like pinnacanths. In comparison to *M. douglasii, M. cardiacensis* has fewer leaves in the crown, pale yellow callous bases and smaller cones with longer spine-like appendages on the distal megasporophylls. The allozyme analysis indicates a closer relationship between *M. douglasii* and *M. cardiacensis* than

between *M. douglasii* and the other species (Fig. 1).

The male cones of *M. douglasii* are destroyed rapidly by the larvae of a host-specific Curculionid weevil (*Tranes* sp.) after shedding pollen (Forster et al. 1994). This activity results in a complete lack of male cones on plants once pollen shedding has ceased and is one reason for a paucity of preserved material in herbaria. Hill (1998) states that "pollen cones not seen", yet these are described by both Mueller (1883), Bailey (1883) and Ballard (1936) and well illustrated in the latter.

Conservation status: This species is locally abundant and grows in scattered, sometimes dense colonies with strong seedling recruitment. It is not rare or threatened and is very well conserved in Cooloola and Fraser Island National Parks.

Etymology: Named for John Douglas (1828-1904), a politician and administrator in Queensland and British New Guinea (Joyce 1972). Douglas, a short-term Premier of Queensland, was considered a "leader in Brisbane's intellectual, literary and religious circles" and became involved in a number of societies (e.g. Royal Society of Queensland, Acclimatization Society of Queensland) along with Hill and Bailey. The naming can be interpreted as being one of political patronage. Port Douglas in north Queensland is also named after him.

3. Macrozamia longispina P.I.Forst. & D.L.Jones *in* P.McCarthy (ed), *Flora of Australia* 48: 717 (1998). **Type:** Queensland. WIDE BAY DISTRICT: State Forest 639, Wrattens, 25 October 1992, *P.I.Forster PIF12137B & P.Machin* (holo: BRI).

***Illustrations*:** Forster & Osborne (2001).

Caudex subterranean or less commonly an erect emergent trunk to 30 cm long and 30 cm diam., unbranched. Young leaves light green. Mature leaves elliptic-lanceolate in outline, 1–1.5 m long, obliquely erect to spreading, dark green, glossy, flat in cross-section, arching in profile, 6–20 in a moderately dense crown; expanded leaf base 25–35 × 1.2–1.5 cm, covered with grey-brown, soft woolly hairs; petiole (including the expanded base) 40–50 cm long, 0.4–0.5 cm wide at lowest pair of leaflets, flat adaxially, convex and angular abaxially; rhachis straight, not twisted, green, the cross-section similar to that of the petiole; leaflets 100–140, inserted at about 40° to the rhachis, widely spreading, crowded, distal leaflets densely packed, proximal leaflets more widely spaced, narrowly linear-lanceolate, 25–32 cm × 3–6 mm, flat, thin-textured, hypostomatic, dark green and glossy adaxially, paler beneath, contracted proximally to a white callous base, margins entire, tapered to a pungent apex; lower leaflets reduced in size but not spine-like. Male cones 1–5, cylindrical to fusiform, 8–15 cm × 2.5–4 cm, straight or curved with age, green; peduncle 15–28 cm × 0.5–1.5 cm; microsporophylls cuneate, 1.2–1.6 cm x 0.8–1.3 cm, with an erect, apical spine 0.5–2 cm long. Female cones 1–3, narrowly ovoid, 13–19 cm × 6–8 cm, green; peduncle 20–26 × 1–1.5 cm; megasporophylls broadly cuneate, 2.8–3.5 × 3.0–3.7 cm, with an erect, apical spine 2.5–7 cm long, the distal sporophylls with spines 4.5–7 cm long. Seeds oblong to obovoid, 2–2.5 cm × 1.5–2 cm, sarcotesta orange to red. (Figs. 9-10).

***Selected specimens*: Queensland**. WIDE BAY DISTRICT: Myravale, Dec 1964, *Clifford* (AQ142047 & AQ321067) (BRI); *ibid*, Apr 1965, *Clifford* (AQ142047) (BRI); S.F.639 Wrattens, Oct 1992, *Forster* PIF12137A-C (BRI); ditto, Feb 1993, *Forster* PIF13140 (BRI); Widgee Mt, Oct 1992, *Forster* PIF12120A & B (BRI); ditto, Feb 1993, *Forster* PIF13143 & *Machin* (BRI); ditto, Apr 1996, *Forster* PIF19138 & *Leiper* (BRI); S.F. 57 St Mary, Jun 1993, *Forster* PIF13374 & *Machin* (BRI).

Distribution and habitat: *Macrozamia longispina* (Map 1) occurs in south-eastern Queensland where it is mainly restricted to the vicinity of Glastonbury and Widgee west of Gympie, with an outlying population to the north at State Forest 57. It grows at altitudes between 420 and 680 m on slopes and ridges in tall moist eucalypt forest in shallow skeletal soils derived from serpentinite, or more rarely on deep sand. Common canopy species include *Eucalyptus biturbinata*, *E. acmenoides*, *E. tereticornis* and *Corymbia intermedia.*

Phenology: Cones shed pollen in October and November and are attended by the thrips

Fig. 9. *Macrozamia longispina*. Adult male plant in habitat. *Forster* PIF12137B & *Machin*. Photo: P.I.Forster.

Cycadothrips chadwickii (Forster et al. 1994). Ripe seed are dispersed in March and April.

Notes: *Macrozamia longispina* is similar to *M. macleayi, M. miquelii* and *M. mountperriensis* but differs from all these species by possessing leaves with fewer, narrower leaflets and markedly longer spines on the distal sporophylls of both the male and female cones. *Macrozamia longispina* is undoubtedly most closely allied to *M. mountperriensis* and differs in the leaves with fewer leaflets (usually 52–58 versus 70–86), narrower median leaflets (4.5–6 mm versus 6.5–9 mm) and in the apical sporophylls of the male cones having much longer spines (15–20 mm versus 3–13 mm). The allozyme analysis also supports the close relationship of these two species with the outlying and sand-dwelling population of *M. longispina* at State Forest 57 clustering more closely with the serpentine populations of that species, rather than the geographically nearby populations of *M. mountperriensis* (Fig. 1).

Conservation status: Although of restricted distribution the species is extremely abundant where it occurs with large numbers present in Wrattens State Forest and at one restricted locality in St Mary State Forest. Populations near Glastonbury appear to have been largely eradicated by local landowners because of their toxicity to domestic stock. The species is listed as Rare on the schedules of the Queenslnad Nature Conservation Act 1992.

Etymology: The specific epithet is derived from the Latin words *longi* (longer) and *spina* (a spine), alluding to the long apical spines on the distal microsporophylls.

4. Macrozamia macleayi Miq., *Arch. Néerl. Sci. Exact. Nat.* 3(5): 250 (post June 1868). **Type:** Queensland. MORETON DISTRICT: Moreton Bay, s.coll., s.dat. (holo U028258), *fide* Forster (1999b).

Macrozamia cylindrica C.Moore, *J. & Proc. Roy. Soc. New South Wales* 17: 119 (1884); *M. spiralis* var. *cylindrica* (C.Moore) Maiden & Betche, *Census New South Wales Pl.* 9 (1916), *nom. illeg. non* Regel (1876); *M. tridentata* subsp.

Fig. 10. *Macrozamia longispina.* Fruiting cone. *Forster* PIF19138 & *Leiper*. Photo: P.I.Forster.

cylindrica (C.Moore) J.Schust. in A.Engler, *Pflanzenr.* 99(IV, I): 91 (1932). **Type:** New South Wales. between the Upper Richmond and Clarence River, 1861, *C.Moore* (holo: NSW).

***Illustrations*:** Williams (1984: 187); Stanley & Ross (1989: 451)[all as *M. miquelii*].

Caudex usually subterranean, occasionally emergent, erect, columnar or barrel-shaped, to 35 cm tall and 30 cm diam., unbranched. Young leaves light green. Mature leaves elliptic-lanceolate in outline, 0.5–2 m long, obliquely erect to spreading, dark green, glossy, flat in cross-section, arching in profile, 6–50 in a moderately dense crown; expanded leaf base 8–12 cm × 2.5–3.5 cm, covered with grey-brown, soft woolly hairs; petiole (including the expanded base) 10–30 cm long, 0.8–1.2 cm wide at the first leaflet, greenish, flat adaxially, convex and angular abaxially; rhachis straight, not twisted or slightly twisted, pale green, the cross-section similar to that of the petiole; leaflets 80–160, inserted at about 40° to the rhachis, widely spreading, moderately crowded, distal leaflets densely packed, proximal leaflets becoming more widely spaced, narrowly linear-lanceolate, 15–50 cm × 6–9 mm, flat, thin-textured, hypostomatic, dark green and glossy

Fig. 11. *Macrozamia macleayi.* Adult male plant in habitat. *Forster* PIF12277B & *Machin*. Photo: P.I.Forster.

adaxially, slightly paler beneath, contracted proximally to a whitish callous base, margins entire, tapered to a pungent apex; lower leaflets gradually reduced to 8–28 pairs of rigid pinnacanths. Male cones 1–5, cylindrical, 15–20 cm × 3.8–6.5 cm, straight or curved with age, green; peduncle 15–29 cm × 1.5–2 cm, elliptical to round in cross-section; microsporophylls broadly cuneate, 1.5–2.5 cm × 1–1.5 cm, with an erect, apical spine 0.5–1.5 cm long. Female cones 1 or 2, cylindrical to barrel-shaped, 19–30 cm × 7–10 cm, green; peduncle 15–41 cm × 2–3 cm, elliptical in cross-section, furrowed; megasporophylls broadly wedge-shaped, 1.5–2.5 cm × 3–3.5 cm, with an erect apical spine 0.5–4.5 cm long, the distal sporophylls with spines 2.5–4.5 cm long. Seeds oblong to obovoid, 2.5–3.5 cm × 1.5–2.5 cm, sarcotesta orange to red. Figs. 11–13.

***Selected specimens examined*: Queensland.** Port Curtis District: Mt Colosseum, Nov 1992, *Forster* PIF12248 & *Machin* (BRI); Blackmans Gap, Nov 1992, *Forster* PIF12277A & B & *Machin* (BRI); Koolkoorum Creek Scientific Area 54, S.F. 121, Nov 1992, *Forster* PIF12285A & B & *Machin* (BRI); 8.5 km along road to Bulburin forestry camp site, Nov 1992, *Forster* PIF12289A & B & *Machin* (BRI); hill c. 2 km S of Mt Colosseum, S of Miriam Vale, May 1992, *Jones* 9394, *Jones & Forster* (BRI, CANB). Burnett District: Mt Takilberan, Wanbar S.F., Aug 1995, *Crane* 1268 (BRI); Burnett Range, S.F.54, Nov 1992, *Forster* PIF12299A & B & *Machin* (BRI); Kalpowar to Gin Gin road, Sep 1993, *Forster* PIF13980A & B & *Machin* (BRI). Wide Bay District: Burnett Range, 1.5 km NW of Mt Bania, Sep 1993, *Forster* PIF13983 & *Machin* (BRI); Mt Gaeta, c. 36 km N of Mt Perry township, Oct 1993, *Forster* PIF14174 (BRI); S.F.256 Imbil, Mitchell L.A., Feb 1993, *Forster* PIF13146A & B & *Machin* (BRI). Moreton District: Flaggy Creek tributary, 6 km E of Lake Manchester, May 1992, *Bostock* 1348 (BRI); Scientific Area 2, S.F. 309, May 1992, *Forster* PIF9885B & *Machin* (BRI); Brisbane Forest Park, Jan 1992, *Forster* PIF9355 & *Machin* (BRI); ditto, May 1992, *Forster* PIF9886A & *Machin* (BRI); 2 km NW of Mt Beerburrum, Jun 1994, *Forster* PIF15239 & *Machin* (BRI); Jolly's Lookout track to South Boundary road, Brisbane Forest Park, Nov 1991, *Machin* AQ517082 (BRI); Brisbane Forest Park, May 1993, *Machin (Jones* 11536*)* (CANB); S.F. 309, Enoggera, Apr 1970, *Moriarty* 120 (BRI, CANB); Brookfield, Dec 1888, *Simmonds* AQ142052 (BRI); Mt Nebo, Dec 1960, *Trapnell* AQ142053 (BRI).

***Distribution and habitat*:** *Macrozamia macleayi* (Map 1) is disjunctly distributed from Mt Colosseum near Miriam Vale in the Port Curtis District, south to the Brisbane region in the Moreton District, with a reported disjunct occurrence in northeastern New South Wales based on the 1861 type collection of *M. cylindrica* "between the Upper Richmond

Fig. 12. *Macrozamia macleayi.* Female cone. Imbil. Photo: D.L.Jones.

River and Clarence River"(Harden 1990; Hill 1998). There are no recent collections from New South Wales and this record should be regarded as extremely dubious. Plants grow at altitudes from 100 to 500 m in the understorey of araucarian microphyll vineforest or in open forest that is often dominated by *Eucalyptus acmenoides, E. crebra, E. major, E. microcorys* and *Lophostemon confertus*.

Phenology: Cones shed pollen October and November and are attended by the thrips *Cycadothrips chadwickii* (Forster et al. 1994). Ripe seeds are dispersed March and April.

Typification: See discussion in Forster (1999b).

Notes: This species is most closely related to, and has previously been included under, *M. miquelii* (cf. Johnson 1959; Hill 1998), but it has a more southerly distribution, and can be distinguished by its glossier, thinner-textured leaflets and smaller female cones. The allozyme analysis indicates that the northern populations near Miriam Vale are more closely related to one another than the disjunct population at Imbil (Fig. 1). Isozyme analysis incorporating the populations near Brisbane would be useful in further elucidation of these relationships.

Conservation status: This species is abundant and well conserved in Brisbane Forest Park

Fig. 13. *Macrozamia macleayi*. Male and female cones. *Forster* PIF12277A & B & *Machin*. Photo: P.I.Forster.

where it is present in both National Parks and State Forests. The northern populations are well represented in State Forests.

Etymology: Probably named for William John Macleay (1820-1891), scientist and pastoralist and a stalwart of the Linnean Society of New South Wales (Australian Encylopaedia 1996). Miquel (1868a,b) states "Nascur in Novâ Hollandiâ orientali, in regione fl. Moreton, ubi probabititer detexit MacLeay".

5. Macrozamia miquelii (F.Muell.) A.DC., *Prodr.* 16(2): 535 (1868).

Encephalartos miquelii F.Muell., *Fragm.* 3: 38 (1862); *M. tridentata* var. *miquelii* (F.Muell.) J.Schust., in A.Engler, *Pflanzenr.* 99(IV, I): 90 (1932); *M. tridentata* var. *oblongifolia* Regel, *Trudy Imp. S.-Peterburgsk. Bot. Sada* 4: 320 (1876), *M. miquelii* cited as basionym; *M. tridentata* f. *oblongifolia* (Regel) J.Schust., in A.Engler, *Pflanzenr.* 99(IV, I): 93 (1932). **Type:** Queensland. Rockhampton, *A.Thozet* (lecto MEL; isolecto: K, n.v.) designated by Johnson (1959).

Macrozamia tridentata f. *milkaui* J.Schust., in A.Engler, *Pflanzenr.* 99(IV, I): 90 (1932). **Type:** Queensland. around Rockhampton, 11 May 1902, *L.Diels* 8249 (holo: B, destroyed).

***Illustrations*:** Jones (1993: 248, upper plate).

Caudex usually subterranean, occasionally emergent, erect, columnar or barrel-shaped, to 50 cm long and 45 cm diam., unbranched. Young leaves light green. Mature leaves elliptic-lanceolate in outline, 0.5–2.3 m long, obliquely erect to spreading, dark green, dull to slightly glossy, flat in cross-section, arching in profile, 20–80 in a dense crown; expanded leaf base 8–15 cm × 3–4 cm, covered with grey-brown, soft woolly hairs; petiole (including the expanded base) 20–40 cm long, 8–20 mm wide at the first leaflet, greenish, flat adaxially, convex and angular abaxially; rhachis straight, not twisted or slightly twisted, pale green, the cross-section similar to that of the petiole; leaflets 80–180, inserted at about 40° to the rhachis, widely spreading, moderately crowded,

Fig. 14. *Macrozamia miquelii.* Adult male plant in habitat. *Forster* PIF12262B & *Machin.* Photo: P.I.Forster.

distal leaflets densely packed, proximal leaflets becoming more widely spaced, linear, 15–50 cm × 6–12 mm, flat, thick-textured, hypostomatic, dark green and dull to slightly glossy adaxially, slightly paler beneath, contracted proximally to a whitish or rarely reddish callous base, margins entire, tapered to a pungent apex; lower leaflets gradually reduced to 6–16 pairs of rigid pinnacanths. Male cones 1–5, cylindrical to fusiform, 12–28 cm × 3.8–6.5 cm, straight or curved with age, green; peduncle 11–30 cm × 1.5–2.5 cm, elliptical to round in cross-section; microsporophylls broadly cuneate, 1.2–2.5 cm × 0.8–1.5 cm, with an erect, apical spine 0.2–2 cm long. Female cones 1–3, cylindrical to barrel-shaped, 25–40 cm × 10-15 cm, green; peduncle 10–30 cm × 2–3 cm, elliptical in cross-section, furrowed; megasporophylls broadly wedge-shaped, 1.5–3 cm × 2.5–4 cm, with an erect, apical spine 0–4.5 cm long, the distal sporophylls with spines 2–4.5 cm long. Seeds oblong to ovoid, 2–3 cm × 1.5–2 cm, sarcotesta yellowish, light orange or red. (Figs. 14–16).

***Selected specimens*: Queensland.** Port Curtis District: Western slopes of Mt Beserker, Beserker Range, Apr 1985, *Forster* PIF1991 (BRI); Mt Morgan, top of Razorback, Nov 1992, *Forster* PIF12251A-C (BRI); Mt Archer summit, Nov 1992, *Forster* PIF12252A & B & *Machin* (BRI); Mt Archer, 2 km from summit, Nov 1992, *Forster* PIF12253A & B & *Machin* (BRI); Waterpark Creek,

Fig. 15. *Macrozamia miquelii*. Female cone. Byfield. Photo: D.L.Jones.

SE of Byfield township, Nov 1992, *Forster* PIF12259A-C & *Machin* (BRI); 4 km NW of Byfield township, Nov 1992, *Forster* PIF12262A & B & *Machin* (BRI); northern end of Windmill Plains, Nov 1992, *Forster* PIF12263A & B & *Machin* (BRI); Ross Range, 6.5 km along Keppel Sands road off Emu Park road, Nov 1992, *Forster* PIF12268 & *Machin* (BRI); Byfield N.P., The Peaks area, 8 km NE of Byfield, Sep 2000, *Forster* PIF26232 & *Booth* (BRI); c.7.4 km N of Farnborough State School, beside road to Byfield, May 1992, *Jones* 9393 & *Jones* (CANB).

Distribution and habitat: *Macrozamia miquelii* (Map 1) is distributed in the Port Curtis District from near Mt Larcom to north of Byfield. Plants grow at altitudes between 10 and 540 m in open forest or woodland dominated by eucalypts, often on stony soil (e.g. trachyte at The Peaks), but at Byfield they grow on deep sand. At some localities the dominant canopy species is *Corymbia citriodora* and *Eucalyptus crebra*, whereas at others it is *Corymbia intermedia* and *Eucalyptus umbra.*

Phenology: Cones shed pollen from October to November and are attended by the thrips *Cycadothrips chadwickii* (Forster et al. 1994). Ripe seeds are dispersed in March and April.

Typification: When originally named, this species had three collections from different localities cited. Johnson (1959) lectotypified the name using the *Thozet* collection from Rockhampton, although Mueller had himself

Fig. 16. *Macrozamia miquelii*. Male and female cones. *Forster* PIF12263A & B & *Machin*. Photo: P.I.Forster.

already indicated a preferred application (Forster 1999a). A proposal to conserve the name with Johnson's lectotype (Forster 1999a) has been rejected by the IAPT committee for nomenclature (Brummitt 2001) as it was considered that Mueller's later attempt at restricting application of the name did not equate to lectotypification.

Notes: *Macrozamia miquelii* is very closely allied to *M. macleayi* (which has a more southerly distribution), but can be distinguished from that species by its duller, thicker-textured leaflets and larger female cones. The close relationship of these two species is reinforced by the allozyme analysis (Fig. 1). The female cones of *M. miquelii* are also very similar to those of *M. douglasii,* but *M. miquelii* has 6–16 pairs of prominent pinnacanths towards the base of the leaf as opposed to 1–4 pairs in *M. douglasii*. *M. serpentina* is also allied to *M. miquelii* but is smaller growing with fewer, shorter leaves, smaller leaflets, smaller male and female cones and smaller seeds. *Macrozamia cardiacensis, M. longispina* and *M. mountperriensis* are all superficially similar to *M. miquelii*. See under those species for differences.

Conservation status: Widespread and abundant with a number of populations in conservation reserves (e.g. Byfield National Park, Mt Archer National Park).

Etymology: Named for F.A.W.Miquel (1811-1871), Dutch botanist and early pioneer of cycad systematics.

6. Macrozamia mountperriensis F.M.Bailey, *Syn. Queensland Fl.*, Suppl. 1: 50 (1886). *Macrozamia tridentata* subsp. *mountperriensis* (F.M.Bailey) J.Schust., in A.Engler, *Pflanzenr.* 99(IV,I): 89 (1932).**Type:** Queensland. Adjacent to Schuh Lookout, W of Mt Perry, 29 Aug. 1990, *D.L.Jones 6340 & B.E.Jones* (neo: CANB; isoneo: BRI, NSW), *fide* Forster & Jones (1992).

***Illustrations*:** Bailey (1913: 516, 517); Jones (1993: 250).

Caudex usually subterranean, occasionally emergent, cylindrical to columnar, to 30 cm long and 40 cm diam. unbranched. Young leaves light green to yellowish green. Mature leaves elliptic-lanceolate in outline, 0.6–1.5 m long, obliquely

Fig. 17. *Macrozamia mountperriensis*. Adult female plant in habitat. *Forster* PIF9343. Photo: P.I.Forster.

erect to spreading, light green to yellowish green, flat in cross-section, arching in profile, 10–80 in a dense crown; expanded leaf base 6–12 cm × 2–3.5 cm, covered with light grey, soft woolly hairs; petiole (including the expanded base) 30–65 cm long, 7–10 mm wide at the first leaflet, pale green, ridged above, convex and angular beneath; rhachis straight, not twisted or with a slight twist, greenish white, the cross-section similar to that of the petiole; leaflets 50–110, inserted at about 40° to the rhachis, moderately crowded, evenly spaced throughout except those towards the base which are more widely spaced, linear, 20–35 cm × 6–9 mm, flat, hypostomatic, thin-textured, light green to yellowish, contracted proximally to a whitish callous base, margins entire, tapered to a sharp apex; lower leaflets slightly smaller but not spine-like. Male cones 1–4, cylindrical, 12–25 cm × 2.5–4 cm, usually curved, green; peduncle 12–22 cm × 1–1.5 cm, elliptical in cross-section; microsporophylls cuneate, 1–1.5 cm × 0.6–1.4 cm, with an erect, apical spine 0.2–1.2 cm long. Female cones 1 or 2, cylindrical to barrel-shaped, 17–30 cm × 6–10 cm, green; peduncle 23–40 cm × 1.5–2.5 cm; megasporophylls broadly cuneate, 1.5–3 cm × 2.5–3.5 cm, with an erect, apical, spine 0.5–4 cm long, the distal sporophylls with spines 2.5–4 cm long. Seeds ovoid to oblong, 2–2.5 cm x 1.5–2 cm, sarcotesta orange to red or yellow. (Figs. 17–18).

***Selected specimens*: Queensland.** Wide Bay District: Stony Creek, 4 km E of Didcot, Dec 1984, *Forster* PIF1966 (BRI); Farrels Scrub, Deep Creek road, Oct 1991, *Forster* PIF9128 (BRI, CANB, MEL); S.F.1294 Brooweena, Jan 1992, *Forster* PIF9343 & *Machin* (BRI, MEL); Fairlies Knob N.P., Seaview Range, Dec 1992, *Forster* PIF12571 (BRI); Stoney Range, S.F.38, Jun 1993, *Forster* PIF13321 (BRI); Seaview Range, Doongul L.A., S.F. 1294, Jun 1993, *Forster* PIF13372 (BRI); S.F. 57 St Mary, Jun 1993, *Forster* PIF13374 & *Machin* (BRI); 7 km from Mt Perry on Monto road, Sep 1993, *Forster* PIF13984 (BRI). Burnett District: 2 km SW of Boolbunda Rock, May 1986, *Forster* PIF2423 (BRI); Goodnight Scrub, Kalliwa Creek area, Dec 1986, *Forster* PIF2771 (BRI); Goodnight Scrub, May 1991, *Jones* 9388, *Jones & Forster* (CANB).

***Distribution and habitat*:** *Macrozamia mountperriensis* (Map 1) is distributed from the Mount Perry region to the west of Bundaberg, south to Brooweena and east to Aramara. This species grows at altitudes between 200 and 450m on sheltered slopes, ridges and gullies under sparse tall dry sclerophyll open forest or woodland in gravelly loams derived from granite

Fig. 18. *Macrozamia mountperriensis.* Female cone. Mt Perry neotype locality. Photo: D.L.Jones.

or granodiorite (rarely sandstone), and also in Araucarian microphyll vine forests on red-brown volcanic loams. Associated canopy species in open forest and woodland include *Angophora leiocarpa, Corymbia citriodora, C. trachyphloia, Eucalyptus acmenoides, E. crebra* and *E. siderophloia.*

Phenology: Pollen shedding occurs in October and November. The cones are attended by the thrips *Cycadothrips chadwickii* (Forster et al. 1994). Ripe seed is shed in March and April.

***Notes*:** *Macrozamia mountperriensis* can be distinguished from *M. miquelii* by its shorter paler green leaves with proportionately longer petioles, the absence of pinnacanths, much smaller cones and smaller seeds. *M. longispina* has more, narrower leaflets, smaller male cones and the distal megasporophylls have longer spines (see discussion under that species).

Conservation status: *M. mountperriensis* is locally abundant in extensive colonies with strong seedling recruitment. The species is widespread and well represented in a number of National Parks and several State Forests. It is not rare or threatened at present.

Etymology: Named for the township of Mount Perry where the species was first discovered.

Fig. 19. *Macrozamia serpentina*. Adult female plant in habitat. *Forster* PIF9408A & *Machin*. Photo: P.I.Forster.

7. Macrozamia serpentina D.L.Jones and P.I.Forst. **sp. nov.** affinis *M. miquelii* (F.Muell.) A.DC. sed statura minor foliis paucioribus (5–12 adversum 20–80), foliolis paucioribus (70–100 adversum 80–180), strobilis masculinis parvioribus tenuioribus (2.5–3.5 cm diam. adversum 3.8–6.5 cm) et strobilis femineis parvioribus tenuioribus (14–22 x 6.5–8 cm adversum 25–40 x 10–15 cm) spinis distalibus brevioribus (1.5–2 cm adversum 2–4.5 cm) differens. **Typus:** Queensland. PORT CURTIS DISTRICT: 1 km W of Glen Geddes, 4 November 1992, *P.I.Forster* PIF12266 & *P.Machin* (holo: BRI; iso: CANB).

Macrozamia sp. (Marlborough P.I.Forster +PIF12269A) (Forster 1997).

Caudex subterranean, ovoid, to 30 cm long, 15–25 cm diam., unbranched. Young leaves light green. Mature leaves broadly elliptic in outline, 0.2–1 m long, obliquely erect to spreading, dark green, semi-glossy, flat in cross-section, arching in profile, 5–12 in a sparse crown; expanded leaf base 6–10 cm x 2–3 cm, covered with grey, soft woolly hairs; petiole (including the expanded base) 2–15 cm long, 6–12 mm wide at the first leaflet, pale green, flat to shallowly convex adaxially, angular abaxially; rhachis

Fig. 20. *Macrozamia serpentina*. Female cone. Glen Geddes. Photo: D.L.Jones.

straight, not twisted or slightly twisted, pale green, the cross-section similar to that of the petiole; leaflets 70–100, inserted at 40–60° to the rhachis, widely spreading, uncrowded, distal leaflets densely packed, proximal leaflets becoming more widely spaced, linear, 15–45 cm x 4–8 mm, flat, thick-textured, hypostomatic, dark green and glossy adaxially, slightly paler beneath, contracted proximally to a white callous base, margins entire, tapered to a sharp apex; lower leaflets gradually reduced to 5–8 pairs of rigid pinnacanths. Male cones 1–3, cylindrical, 12–20 cm x 2.5–3.5 cm, straight, curved or slightly twisted with age, green; peduncle 10–18 cm x 7–9 mm, round in cross-section, furrowed; microsporophylls cuneate, 8–12 mm x 4–8 mm, with an erect, apical spine 0–7 mm long, the distal sporophylls with the longest spines. Female cones 1 or 2, cylindrical to barrel-shaped, 14–22 cm x 6.5– 8 cm, green; peduncle 14–20 cm x 12–14 mm, round in cross-section, furrowed; megasporophylls broadly wedge-shaped, 1.5–2.5 cm x 3–3.5 cm, with an erect, apical, spine 0.5–2 cm long, the distal sporophylls with spines 1–2 cm long. Seeds oblong to ovoid, 1.8–2.5 cm x 1.5–2 cm, sarcotesta light orange to red. (Figs. 19–21).

Selected specimens examined: **Queensland**. LEICHHARDT DISTRICT: Marlborough - Glenprairie road, Jul 1998, *Thompson* 1267 & *Fox* (BRI). PORT CURTIS DISTRICT: Coorumburra Station, SSW of Marlborough, May 1998, *Batianoff* 980533W (BRI); Mt Fairview, W of

Fig. 21. *Macrozamia serpentina*. Male cones. *Forster* PIF12266 & *Machin*. Photo: P.I.Forster.

Ridgelands, S.F.114, May 1998, *Batianoff* 980534W (BRI); Glen Geddes, Jul 1987, *Champion* 295 (BRI); Between Canoona and Glen Geddes, Dec 1966, *Everist* 7945 (BRI); Glen Geddes, Jan 1992, *Forster* PIF9408 (BRI, CANB); NNE of Marlborough, Nov 1992, *Forster* PIF12269A & B & *Machin* (BRI); southern slopes of Mt Slopeaway, Nov 1992, *Forster* PIF12273A & B & *Machin* (BRI); E of Glenavon Homestead, Five Mile Creek Headwaters, Mar 1994, *Forster* PIF15041 & *Bean* (BRI); Glen Geddes, 6 May 1992, *Jones* 9389 B & *Jones* (CANB); Glen Geddes, Oct 1991, *Machin* AQ517058 (BRI); Ramilles Block, Jan 1989, *Specht* 146 & *Reeves* (BRI); Glen Geddes, Jan 1989, *Specht* 314 & *Reeves* (BRI).

Distribution and habitat: *Macrozamia serpentina* (Map 1) occurs in the Leichhardt and Port Curtis Districts between Marlborough and Yaamba, north of Rockhampton. It grows at altitudes between 80 and 160 m in low woodland with a mixed grassy and shrubby understorey in red clay loams over serpentinites. Associated canopy species include *Corymbia xanthope* and *Eucalyptus fibrosa*.

Phenology: Cones shed pollen from October to November and are attended by the thrips *Cycadothrips chadwickii* (Forster et al. 1994). Ripe seed are shed from March to May.

Notes: *Macrozamia serpentina* was not mentioned in the account of Hill (1998), although it had been listed as an undescribed species by Forster (1994 & 1997). *Macrozamia serpentina* is closely allied to *M. miquelii* but smaller growing with fewer (5–12 versus 20–80), shorter leaves, smaller and fewer (70–100 versus 80–180), more widely spaced leaflets, smaller and thinner (2.5–3.5 cm diameter versus 3.8–6.5 cm) male cones, and smaller and thinner (14–22 × 6.5–8 cm versus 25–40 × 10–15 cm) female cones that have shorter apical spines on the megasporophylls (1.5–2 cm versus 2–4.5 cm). Incomplete (not included in Fig. 1) allozyme analysis of this species indicates that it is most closely related to *M. miquelii*.

Conservation status: This species is listed as Endangered on the schedules of the Queensland Nature Conservation Act 1992. It is poorly conserved with no populations in conservation reserves. This species co-exists with a range of restricted endemics on serpentinite (Batianoff *et al.* 1991, 2000), in communities which are themselves threatened by clearing, mining and agriculture.

Etymology: The epithet is derived from the Latin *serpentinus*, growing on serpentine rock.

Names of Uncertain Application

Macrozamia mackenzii Hort. Ex Mast., *Gard. Chron.*, n.s. 7: 665 (1877); *M. tridentata* var. *mackenzii* (Hort. ex Mast.) J.Schust., in A.Engler, *Pflanzenr.* 99(IV,I): 90 (1932). **Type**: 'growing in the botanic garden at Brisbane, under the charge of Mr W. Hill'. No specimen is known to exist but an illustration in the Gardeners Chronicle of a cultivated plant places the species as a member of the *M. miquelii* group. This illustration is not diagnostic and is inadequate for identification of the taxon concerned.

Encephalartos spiralis var. *major* Miq., *Verslagen Meded. Afd. Natuurk. Kon. Akad. Wetensch.* 15: 368 (1863). **Type**: "Broad-Sound & Moreton Bays, *F.Mueller;* Jervis Bay, N.S.W., *F.Mueller*; Moreton Bay, *C. Stuart.*

We have not seen any of these syntypes. Given the broad geographic origin of the different collections it is certain that more than one species is involved.

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